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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

### Office Action Summary

**Application No.**

10/553,309

**Applicant(s)**

GRUMMON, DAVID S.

**Examiner**

MARINA TIETJEN

**Art Unit**

3753

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 26 July 2008.  
2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.  
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-37 is/are pending in the application.  
4a) Of the above claim(s) 34-37 is/are withdrawn from consideration.  
5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.  
6) ☒ Claim(s) 1-33 is/are rejected.  
7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.  
8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.  
10) ☒ The drawing(s) filed on 24 July 2008 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).  
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☒ All b) ☐ Some \* c) ☐ None of:  
1. ☒ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)  
2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)  
3) ☒ Information Disclosure Statement(s) (PTO-8508)  
Paper No(s)/Mail Date 10/14/2005  
4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_  
5) ☐ Notice of Informal Patent Application  
6) ☐ Other: \_\_\_\_\_

**DETAILED ACTION**

***Election/Restrictions***

1. Applicant's election without traverse of Invention I, Claims 1-33, in the reply filed on July 24, 2008 is acknowledged. Claims 1, 24, and 29 have been amended, and claims 34-37 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected Invention, there being no allowable generic or linking claim.

***Drawings***

2. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference character(s) not mentioned in the description: 50, Fig. 3; 74, Fig. 9; 96, Figs. 17 and 18. Corrected drawing sheets in compliance with 37 CFR 1.121(d), or amendment to the specification to add the reference character(s) in the description in compliance with 37 CFR 1.121(b) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

***Claim Rejections - 35 USC § 112***

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claim 26 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

5. Regarding claim 26, the phrase "such as" renders the claim indefinite because it is unclear whether the limitations following the phrase are part of the claimed invention. See MPEP § 2173.05(d).

***Claim Rejections - 35 USC § 102***

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

7. **Claims 17, 29, and 32 are rejected under 35 U.S.C. 102(b) as being anticipated by Busch et al. (US. Patent 5,061,914).**

Regarding Claims 17 and 29, Busch et al. discloses a method for producing a plurality of thin film actuators 1 (Fig. 1a) comprising: a) sputter depositing a film of a shape memory alloy material (col. 3, lines 29-36) onto a polyimide film (Kapton being a polyimide, col. 7, lines 38-43) to form a shape memory alloy construction; b) annealing

the shape memory alloy construction (col. 6, lines 5-15); c) imparting a 2 to 8% strain to the shape memory alloy construction (col. 6, lines 18-22); and d) conducting a post straining process (etching process, col. 6, lines 25-28) on the shape memory alloy construction after the step of imparting a 2 to 8% strain.

Regarding Claim 32, Busch et al. discloses etching the shape memory alloy film using a photolithographic method (col. 6, lines 28-32), wherein the polymer film 1 is substantially unaffected by the photolithographic method (Fig. 3d).

***Claim Rejections - 35 USC § 103***

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. **Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Busch et al. (US. Patent 5,061,914) in view of Parodi (US PGPub 2002/0177891).**

Regarding Claim 18, Busch et al. discloses the invention as essentially claimed, except for cutting the shape memory alloy construction to form a plurality of thin film actuators after the step of conducting a post annealing process.

Parodi teaches cutting the shape memory alloy construction to form a plurality of thin film actuators after the step of conducting a post annealing process (para. 0024) for the purpose of creating a localized portions that are plastically deformable as needed

(para. 007) and to create both plastically deformable and superelastic regions in the same element (para. 0024).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Busch's invention to include cutting the shape memory alloy construction to form a plurality of thin film actuators after the step of conducting a post annealing process, as suggested and taught by Parodi, for the purpose of creating localized portions that are plastically deformable as needed and to create both plastically deformable and superelastic regions in the same element.

**10. Claims 19-20 and 30-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Busch et al. (US. Patent 5,061,914).**

Regarding Claims 19-20 and 30-31, the examiner takes Official Notice that imparting strain to a polymer film can be performed axially or biaxially. One of ordinary skill in the art would have found it obvious to impart strain on the SMA polymer film in an axial or biaxial direction as suitable for the intended use as a matter of design choice.

**11. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Busch et al. (US. Patent 5,061,914) in view of Johnson et al. (5,619,177).**

Regarding Claim 21, Busch discloses the invention as essentially claimed, except for the TiNi film of shape memory alloy was selected from the group consisting of TiNiPd, TiNiAu, TiNiZr, TiNiHf, TiNiPt and combinations thereof.

Johnson et al. teaches of using TiNiPd as a shape memory alloy for an actuator since it can be easily deformed when cold, produces large stress forces, and has a

shape recovery of several percent when heated through the transition temperature (col. 5, lines 57-64).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Busch's invention such that the shape memory alloy material be TiNiPd, as suggested and taught by Johnson et al., for the purpose of using a material with desirable attributes for creating an actuator, such as being easily deformed when cold, producing large stress forces, and having a shape recovery of several percent when heated through the transition temperature.

**12. Claims 22-23, and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Busch et al. (US. Patent 5,061,914) in view of Ishida et al. (US PGPub 2001/0021290).**

Regarding Claim 22, Busch et al. discloses the invention as essentially claimed, including the step of exposing the shape memory alloy layer to a photo resist mask (col. 6, lines 25-28). However, Busch et al. does not disclose cutting the polymer film into a plurality of actuators.

Ishida et al. teaches of cutting the polymer film into a plurality of actuators after masking areas of the film (Fig. 2) for the purpose of producing a plurality of actuators (para. 0030-0031) in an easy cost and labor effective manner (para. 0011).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Busch's invention to include cutting the polymer film into a plurality of actuators after masking areas of the film, as suggested

and taught by Ishida, for the purpose of producing a plurality of actuators in an easy cost and labor effective manner.

Regarding Claim 23 and 33, Busch discloses the invention as essentially claimed, including etching the shape memory alloy material (col. 6, lines 25-28). However, Busch et al. does not disclose cutting the polymer film into a plurality of actuators.

Ishida et al. teaches of etching the shape memory alloy material prior to cutting the polymer film into a plurality of actuators (Fig. 2) for the purpose of producing a plurality of actuators (para. 0030-0031) in an easy cost and labor effective manner (para. 0011).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Busch's invention such that the etching of the shape memory alloy material is performed prior to cutting the polymer film into a plurality of actuators, as suggested and taught by Ishida et al., for the purpose of producing a plurality of actuators in an easy cost and labor effective manner.

**13. Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Busch et al. (US. Patent 5,061,914) in view of Ingram (US Patent 5,836,066).**

Regarding Claim 24, Busch et al. discloses the invention as essentially claimed, except for the step of imparting strain to the polymer film comprises the steps of placing the shape memory alloy construction over a die, and applying differential pressure into the die to deform the shape memory alloy construction.



Ingram teaches the step of imparting strain to the polymer film comprises the steps of placing the shape memory alloy construction over a die 610 (Fig. 6a), and applying differential pressure (due to the curved shape of the die) into the die for the purpose of applying strain to the shape memory alloy construction without forming ripples therein (col. 7, lines 6-12).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Busch's invention such that the step of imparting strain to the polymer film comprises the steps of placing the shape memory alloy construction over a die, and applying differential pressure into the die, as suggested and taught by Ingram, for the purpose of applying strain to the shape memory alloy construction without forming ripples therein.

**14. Claim 25-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Busch et al. (US. Patent 5,061,914) in view of Ingram (US Patent 5,836,066) further in view of Cheng et al. (US PGPub 2004/0074065).**

Regarding Claims 25-26, Busch/Ingram disclose the invention as essentially claimed, except for subjecting the shape memory alloy layer to ion irradiation to a depth of about one-half the thickness of the shape memory alloy layer, wherein subjecting the shape memory alloy layer to heavy ion irradiation is subjecting the shape memory alloy layer with heavy ions such as argon or krypton to damage the crystal structures to a degree that reverse transformation to the austenite is prevented.

Cheng et al. teaches subjecting the shape memory alloy layer to heavy ion radiation for the purpose of imparting a shape to the alloy layer by surface treatment (para. 0031).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Busch/Ingram's invention to include subjecting the shape memory alloy layer to heavy ion radiation, as suggested and taught by Cheng et al., for the purpose of imparting a shape to the alloy layer by surface treatment. However, Chen does not specifically teach the ion irradiation is to a depth of about one-half the thickness of the shape memory alloy or that the damage to the crystal structures is to a degree that reverse transformation to the austenite is prevented.

However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to subject the shape memory alloy layer to ion irradiation to a depth of about one-half the thickness of the shape memory alloy layer or to a degree that reverse transformation to the austenite is prevented, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

**15. Claim 27 is rejected under 35 U.S.C. 103(a) as being unpatentable over Busch et al. (US Patent 5,061,914) in view of Ingram (US Patent 5,836,066) further in view of Cheng et al. (US PGPub 2004/0074065) further in view of Wetzel (US Patent 6,773,535).**

Regarding Claim 27, Busch/Ingram/Cheng disclose the invention as essentially claimed, except for cutting the polymer film to form a plurality of thin film actuators after the step of imparting a strain.

Wetzel teaches of cutting a film to form a plurality of thin film actuators 5a (Fig. 1) after the step of imparting a strain for the purpose of obtaining shorter strips of desired size (col. 11, lines 64-67) to be further assembled in the strained orientation (col. 12, lines 18-20).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Busch/Ingram/Cheng's invention to cut the film to form a plurality of thin film actuators after the step of imparting a strain, as suggested and taught by Wetzel, for the purpose of obtaining shorter strips of a desired size to be further assembled in the strained orientation, and to simply make a plurality of actuators from a larger stock to avoid doing several production steps on each individual actuator in order to minimize production cost and labor.

**16. Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over Busch et al. (US Patent 5,061,914) in view of Ingram (US Patent 5,836,066) further in view of Cheng et al. (US PGPub 2004/0074065) further in view of Wetzel (US Patent 6,773,535) further in view of Kornrumpf (US Patent 6,655,011).**

Regarding Claim 28, Busch/Ingram/Cheng/Wetzel disclose the invention as essentially claimed, except for coupling two thin film actuators together to form a blister actuator.

Kornrumpf et al. teaches coupling two thin film actuators together to form a blister actuator for the purpose of providing an actuator capable of being manufactured at a micro level and to provide an integral switching mechanism within the high density interconnect circuit environment (col. 1, lines 29-32; col. 2, lines 43-44).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Busch/Ingram/Cheng/Wetzel's invention to include teaches coupling two thin film actuators together to form a blister actuator, as suggested and taught by Kornrumpf et al., for the purpose of providing an actuator capable of being manufactured at a micro level and to provide an integral switching mechanism within the high density interconnect circuit environment.

**17. Claims 1-3 and 5-6 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Busch et al. (US. Patent 5,061,914) in view of Choi et al. (US PGPub. 2003/0062254) further in view of Wetzel (US Patent 6,773,535).**

Regarding Claim 1, Busch et al. discloses the invention as essentially claimed, including depositing a film of a shape memory alloy material (col. 3, lines 29-36) onto the polymer film (Kapton being a polymer, col. 7, lines 38-43) and imparting a strain to the polymer film by 2 to 8% strain. However, Busch et al does not disclose degassing a polymer film in a vacuum and cutting the polymer film to form a plurality of thin film actuators after the step of imparting a strain.

Choi et al. teaches of degassing a polymer film in a vacuum for the purpose of cleaning the substrate of impurities (para. 0057) that could degrade the quality of the actuator.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Busch's invention to include degassing a polymer film in a vacuum, as suggested and taught by Choi et al., for the purpose of cleaning the substrate of impurities that could degrade the quality of the actuator. However, Choi does not disclose cutting the polymer film to form a plurality of thin film actuators after the step of imparting a strain.

Wetzel teaches of cutting a film to form a plurality of thin film actuators 5a (Fig. 1) after the step of imparting a strain for the purpose of obtaining shorter strips of desired size (col. 11, lines 64-67) to be further assembled in the strained orientation (col. 12, lines 18-20)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Busch/Choi's invention to cut the film to form a plurality of thin film actuators after the step of imparting a strain, as suggested and taught by Wetzel, for the purpose of obtaining shorter strips of a desired size to be further assembled in the strained orientation, and to simply make a plurality of actuators from a larger stock to avoid doing several production steps on each individual actuator in order to minimize production cost and labor.

Regarding Claim 2, Busch discloses the polymer film 1 is a polyimide film (Kapton being a polyimide, col. 7, lines 38-43).

Regarding Claim 3, Busch discloses depositing a film of shape memory alloy is sputter coating a layer of shape memory alloy (col. 3, lines 29-36) onto the polymer film.

Regarding Claims 5 and 6, the examiner takes Official Notice that imparting strain to a polymer film can be performed axially or biaxially in a manner known in the art. One of ordinary skill in the art would have found it obvious to impart strain on the SMA polymer film in an axial or biaxial direction as suitable for the intended use as a matter of design choice.

Regarding Claim 13, Busch et al. discloses the step of annealing the shape memory alloy (col. 6, lines 5-6).

**18. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Busch et al. (US Patent 5,061,914) in view of Choi et al. (US PGPub. 2003/0062254) further in view of Wetzel (US Patent 6,773,535) further in view of Johnson et al. (US Patent 5,619,177).**

Regarding Claim 4, Busch/Choi/Wetzel disclose the invention as essentially claimed, except for the TiNi film of shape memory alloy being selected from the group consisting of TiNiPd, TiNiAu, TiNiZr, TiNiHf, TiNiPt and combinations thereof.

Johnson et al. teaches of using TiNiPd as a shape memory alloy for an actuator since it can be easily deformed when cold, produces large stress forces, and has a shape recovery of several percent when heated through the transition temperature (col. 5, lines 57-64).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Busch's invention such that the shape memory alloy material be TiNiPd, as suggested and taught by Johnson et al., for the purpose of using a material with desirable attributes for creating an actuator, such as

being easily deformed when cold, producing large stress forces, and having a shape recovery of several percent when heated through the transition temperature.

**19. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Busch et al. (US. Patent 5,061,914) in view of Choi et al. (US PGPub. 2003/0062254) further in view of Wetzel (US Patent 6,773,535) further in view of Tanaka et al. (US PGPub 2002/0112788).**

Regarding Claim 7, Busch/Choi/Wetzel disclose the invention as essentially claimed, except for the step of imparting a strain in a cyclic manner by heating and cooling under applied uniaxial or biaxial loading with the last cycle ending with strain applied in the fully martensitic condition.

Tanaka et al. teaches the step of imparting a strain in a cyclic manner by heating and cooling under applied weight load (uniaxial or biaxial loading) with the last cycle ending with strain applied in the fully martensitic condition for the purpose of improving the deterioration rate of shape strain recovery of the actuator element (para. 0022).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Busch/Choi/Wetzel's invention such that the strain is done in a cyclic manner by heating and cooling under applied weight load (uniaxial or biaxial loading) with the last cycle ending with strain applied in the fully martensitic condition, as suggested and taught by Tanaka et al., for the purpose of improving the deterioration rate of shape strain recovery of the actuator element.

**20. Claim 8-9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Busch et al. (US. Patent 5,061,914) in view of Choi et al. (US PGPub.**

**2003/0062254) further in view of Wetzel (US Patent 6,773,535) further in view of Ishida et al. (US PGPub 2001/0021290).**

Regarding Claim 8, Busch/Choi/Wetzel disclose the invention as essentially claimed, except for performing the step of exposing the shape memory alloy layer to a photo resist mask prior to cutting the polymer film into a plurality of actuators.

Ishida et al. teaches of exposing the shape memory alloy layer to a photo resist mask prior to cutting the polymer film into a plurality of actuators (Fig. 2) for the purpose of partially forming films on multiple areas at intervals, which are then cut to form a plurality of film actuators (para. 0030-0031). This preparation of actuators enables great labor savings and cost cutting (para. 0011).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Busch/Choi/Wetzel's invention such that the step of exposing the shape memory alloy layer to a photo resist mask prior to cutting the polymer film into a plurality of actuators., as suggested and taught by Ishida et al., for the purpose of partially forming films on multiple areas at intervals, which are then cut to form a plurality of film actuators. This preparation of film actuators enables great labor savings and cost cutting.

Regarding Claim 9, Busch/Choi/Wetzel disclose the invention as essentially claimed, including etching the shape memory alloy material (col. 6, lines 25-28), however does not disclose it performed prior to cutting the polymer film into a plurality of actuators.



Ishida et al. teaches of etching the shape memory alloy material prior to cutting the polymer film into a plurality of actuators (Fig. 2) for the purpose of producing a plurality of actuators (para. 0030-0031) in an easy cost and labor effective manner (para. 0011).

Therefore, it would have been obvious to one invention such that of ordinary skill in the art at the time the invention was made to modify Busch/Choi/Wetzel's such that the etching of the shape memory alloy material occurs prior to cutting the polymer film into a plurality of actuators, as suggested and taught by Ishida et al., for the purpose of producing a plurality of actuators in an easy cost and labor effective manner.

**21. Claims 10-12 and 14-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Busch et al. (US. Patent 5,061,914) in view of Choi et al. (US PGPub. 2003/0062254) further in view of Wetzel (US Patent 6,773,535) further in view of Sugihara et al. (US PGPub 2003/0020502).**

Regarding Claims 10-12 and 14-15, Busch/Choi/Wetzel disclose the invention as essentially claimed, except for sputter coating a second layer of a conductor selected from the group consisting of Cu, Au, Ag, Ni, Cr and combinations thereof, wherein the conductor is between 1 and about 100 microns thick.

Sugihara et al. teaches of sputter coating a second layer of Cr onto a substrate for the purpose of providing a resistance element of a multilayered wiring substrate that has an impurity mixed in the conductor film from the sputtering process which results in a higher resistance value (para. 0083).

Therefore, it would have been obvious to one invention such that of ordinary skill in the art at the time the invention was made to modify Busch/Choi/Wetzel's to include sputter coating a second layer of Cr onto a substrate, as suggested and taught by Sugihara et al., for the purpose of providing a resistance element of a multilayered wiring substrate that has an impurity mixed in the conductor film from the sputtering process which results in a higher resistance value.

However, Sugihara does not directly disclose the conductor is between 1 and about 100 microns thick. Sugihara does disclose the resistance value of the Cr layer can be adjusted by the thickness of the layer (para. 0082).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to adjust the thickness of the Cr layer between 1 and 100 microns, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

Regarding Claim 16, Busch/Choi/Wetzel disclose the invention as essentially claimed, except for the second layer is a plating assist layer.

Sugihara et al. teaches of a second layer of Cr as a plating assist layer for the purpose of enhancing the adhesion of the substrate to the wire (para. 0081).

Therefore, it would have been obvious to one invention such that of ordinary skill in the art at the time the invention was made to modify Busch/Choi/Wetzel's to include a second layer of a plating assist layer, as suggested and taught by Sugihara et al., for the purpose of enhancing the adhesion of the substrate to the wire element.

***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MARINA TIETJEN whose telephone number is (571) 270-5422. The examiner can normally be reached on Mon-Thurs, 9:00AM-5:00PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, GREG HUSON can be reached on (571) 272-4887. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Stephen M. Hepperle/  
Primary Examiner, Art Unit 3753

/M. T./  
Examiner, Art Unit 3753